ANALYSIS OF THE NELCHINA CARIBOU RANGE

R. E. PEGAU

Alaska Dept. of Fish and Game

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INTRODUCTION

The Nelchina caribou (rangifer tarandus) has long been considered one of the most important herds in Alaska because of its ready access from populated areas. The Nelchina caribou range is located in southcentral Alaska, centered about 100 mi (160 km) northeast of Anchorage. Roughly, it is bounded on the south by the Glenn Highway and the Tazlina and Matanuska Rivers, and on the west by the Alaska Railroad, lower Susitna, Chulitna and upper Nenana Rivers. The summit of the Alaska Range forms its northern boundary and the Wrangell Mountains bound it on the east. The Nelchina range encompasses about 20,000 mi^2 (51,799 km^2). The climate of the Nelchina is similar to that of Interior Alaska, but with slightly milder temperatures, ranging from 35° C to -45° C, and greater precipitation, averaging 33 cm. Snowfall occassionally exceeds 100 cm. Range studies have been more intensive with this herd than any other herd in Alaska, Major studies were conducted by Hanson (1958) and Skoog (1968). In 1970, I reexamined the exclosure and reviewed and summarized all the data that had been collected since 1949 (Pegau and Hemming 1972).

The principal caribou habitat lies above timberline in elevations between 3,000 feet. (914 m) and 5,000 ft. (1,524 m), except for Lake Louise Flat. Because the Nelchina range has such varied topography, a multitude of micro-climates exist. One factor of particular importance

is wind, which influences caribou distribution in the summer by providing relief during the peak period of flying insect harassment. Snow conditions are variable and the depth accumulation, as well as icing and layering, determine which areas can be utilized by caribou during the winter months. Little information has been obtained about snow conditions and distribution of snow accumulation, etc.

Vegetation of the Nelchina range is similar to other tundra and taiga regions in the northern hemisphere. Twelve vegetation types have been described on the Nelchina range (Skoog 1968). Six of these are most important to caribou. Black spruce (Picea mariana)and white spruce (P. glauca) occur throughout, at elevations below 3,000 ft. (914 m) with scattered trees extending to 3,500 ft. (1066.8 m). The largest area of spruce cover occurs in the Lake Louise Flat and in the Copper River drainage. Interspersed among the Spruce communities are stands of Aspen-poplar, Meadow, Water Sedge and Bog. Shrub Birch (Betula glandulosa) is the co-dominant with Spruce at elevations between 3,000 ft (914 m) and 3,500 ft (1066.8 m). Willows (Salix spp.) occur on most drainages and Fescue Grass (Festuca altaica) is commonly found in association with the Shrub Birch type. The Heath type (Ericaceae, Carex spp. and Cladonia spp.) is normally found above timberline and is a very important vegetation type in the ecology of the Nelchina herd. Heaths usually occur from 3,000 ft (914 m) upward on dry well-drained sites. The Meadow (Carex spp. and Eriophorum spp.) type occurs on sites with poor drainage up to considerable elevations in the mountains; however, the majority occur below 4,000 ft (1219.2 m).

PROCEDURES

During 1955 and 1956, fifteen exclosures were constructed on the Lake Louise Flat where the Nelchina herd had traditionally wintered. At each

range station, two similar plots, 5 ft (1.524 m) X 20 ft (6.096 m) were delineated; Plot A was fenced to exclude all large animals and Plot B was left open to normal grazing by all animals.

The small size of the exclosures has often been criticized. The criticism is justified if the objective is to determine quantative data on carrying capacity from these small exclosures, as there are several unknown factors (forage availability, snow depth, icing, accurate enumeration of animals utilizing a site for a known length of time, etc.), that negate obtaining carrying capacity estimates by the classical means. However, these exclosures can provide qualitative information on the effects of caribou and other animals on the range in relation to different intensities of grazing and use patterns, successional stages of the vegetation protected from and exposed to grazing, and other factors that are useful in the management of a caribou herd.

The disadvantage of the small size is offset somewhat by the fact that the exclosures were built to provide data on the ground vegetation (lichens, mosses, sedges, grasses and dwarf shrubs) rather than the taller shrubs and trees, and that all plots are at least 3 to 5 ft (.9144 to 1.524 m) from the fence. The effect of the fence on micro-climate has not been determined, but during 1970, when a considerable change in the vegetation was noticeable at several of the Range stations there was no instance where the fence had an apparent effect on the vegetation. Skoog (1968) remarked that at the time of his winter examinations of the exclosures, he could not detect any difference in snow accumulation due to the fence. In my own observations of six exclosures in the Nome area, as well as two in the Selawik and Kobuk Valleys, I have not noticed any indication that the fence influences snow depth, melt, runoff or growth of vegetation.

In 1960, 24 more exclosures were constructed on major Nelchina caribou wintering areas. No attempt was made to do the vegetation analysis that year, as construction of as many exclosures as possible was desired. In 1961 and 1962 vegetation in the exclosures constructed during 1960 was examined. A fenced plot and an unfenced control plot, each containing two m^2 quadrats, were established at each Range Station. The vegetation was analyzed by the modified Hult-Sernander method recommended by Hanson (1958).

RESULTS AND DISCUSSION

Northwestern Quadrant of the Nelchina Range

This area which is Range Units 1-4, is mostly mountainous except for Monahan Flats and nearly 1/4 is bare ground. Shrub Birch, Heath and Meadow predominate. For over 20 years prior to 1956, caribou seldom used the area. Caribou resumed use of this area in 1956, and in the early 60's, it was a major wintering area. Winter use by caribou continued to a lesser extent in the late 1960's. Range examination in the late 1950's and early 1960's revealed excellent lichen stands with Cladonia alpestris often being 15 to 20 cm high. Forage lichens were abundant in the Heath and Shrub Birch types. Sedges were also abundant and provided considerable winter forage (Skoog 1968).

Several range exclosures constructed and examined in 1960 and 1961 revealed the excellent condition of the range. By 1967, there was a very evident deterioration of the range outside of the exclosures, reflecting the resumption of utilization by caribou in the early 1960's.

Within a 5 year period, from 1962 to 1967, rapid destruction of the lichen cover, especially of Cladonia alpestris, had occurred. Scattered,

disrupted lichen stands with numerous gray podents (the decadent portions of Cladonia alpestris) were common in 1967 and clearly showed that Cladonia alpestris cannot withstand continued heavy utilization. It deteriorates rapidly under moderate caribou use, which has been demonstrated in other studies, particularly in Sweden (Skuncke 1969).

Examinations in 1970 revealed that with the disruption of the lichen cover, shrubs were stimulated and increased their growth. There was little noticeable change in other vascular plants.

The effect of trampling on the vegetation, especially lichens, by caribou and moose is demonstrated at several of the exclosures in the Northwestern sector, especially in the vicinity of Soule Lake. In 1961, when the Soule Lake exclosure was constructed, lichen condition was excellent. There were numerous small moss hummocks and grass tussocks. Caribou resumed their use of the area shortly after the exclosure was constructed. In the summer of 1966 nearly the entire Nelchina caribou herd passed through the Soule Lake area. The destruction of the habitat was remarkable. It looked almost as if the area had been spaded, with bare ground exceeding vegetative cover. Lichens outside the exclosure were completely trampled. Other studies in Alaska (Palmer and Rouse 1945, Pegau 1970a), Sweden (Skuncke 1969), and the Soviet Union (Makhaeva 1963, Davydov 1958), have also shown that the effect of trampling during snowfree periods may exceed the damage caused by grazing.

CENTRAL REGION

This region, containing Range Units 5, 8 and 12, lies between two mountain ranges, and rolling foothills are prominent. Shrub Birch, Heath, Meadow, Spruce and Willow are the principal vegetation types. This sector receives some of the most extensive use, as it is the prime summer and calving range with occassional winter use as well. Lichens were abundant in some areas in 1953 but were markedly reduced by the late 1950's. The

preferred species, such as Cladonia alpestris, C. rangiferina and C. arbuscula were in poor condition and being replaced by secondary types such as Cladonia uncialis, C. gracilis, Cetraria cucullata and C. nivalis (Skoog 1959). Lichens have continued to decline in condition through the early 1970's due primarily to trampling during snowfree periods of the year. Inside one 15 year old exclosure Cetraria nivalis was the only lichen that appeared to be recovering from prior use. Shrubs, especially blueberry (Vaccinium uligonosum) and narrow-leaved Labrador tea (Ledum decumbens) have increased but total cover has decreased. Overall the central region is poor winter range, but does provide considerable summer forage. There has been some destruction of the vascular plants as well, reflecting the continuous heavy use.

NORTHCENTRAL REGION

This area, containing Range Units 6 and 9, consists mostly of gentle slopes and rolling terrain. Shrub Birch and Heath predominate. Lichens are prominent in the Shrub Birch stands, but they are mostly unavailable to caribou due to the density and height of the shrub birch. Exclosures located in the Shrub Birch stands contain excellent lichen undergrowth and there is little evidence that they have ever been utilized by caribou. Lichen stands in the few areas exposed to winter grazing have deteriorated in condition during the last ten years. The region contains a considerable amount of good summer and early fall forage.

EASTERN REGION

In the late 1960's to the present, a major portion of the Nelchina caribou wintered principally near the Wrangell Mountains, which is outside what was previously called "normal" range. No range studies have been conducted to date in this area and it is a priority item.

SOUTHWESTERN REGION

This area containing Range Units 10, 11, 14 and 15, is mountainous and nearly 1/4 unvegetated. Heath, Spruce and Meadow are the principal vegetation types. Caribou utilize the area primarily during the winter.

Skoog (1959, 1961) examined several areas that had been used during the winter to determine the amount of area utilized by caribou in the winter. He reported (Skoog and Keough 1961) that 9 months of winter use (3 winters of 3 months each) by over 20,000 caribou on an area of about 100 mi^2 (258 km^2) had resulted in 9 percent of the lichen forage being destroyed and 18 percent grazed lightly. Almost all of this damage occurred in the Heath type, and indicated that under continued heavy use of such intensity, the range probably would deteriorate rapidly. The buffering effect of the Meadow type could not be determined.

SOUTHEASTERN REGION (LAKE LOUISE FLAT)

Over 95 percent of this region lies below 3,000 ft (914 m). Snowfall and winds are light to moderate and the ground becomes free of snow early in the spring. The area is characterized by numerous lakes and ponds with poor drainage. Spruce covers over 75% of the Flat. Water covers 8 percent and associated sedges form extensive stands. Fire has had considerable impact on the flora of the area and the growth of lichens is mostly poor to fair due to the poor drainage, heavy caribou use, and frequent fires.

On most stands the lichen cover is comprised primarily of secondary species, usually Stereocaulon spp. The lichen mat is trampled and its height is usually less than 2.5 to 5 cm. This area had been the major wintering grounds from early in the 1930's until the mid 1950's. Since 1955, however, only small portions of the herd have wintered on the Flat,

although many thousands usually swing across the Flat each year during the October - December period before moving to other wintering areas. This pattern of range use continues, and from vegetation examinations of the range exclosures it appears to be sufficient to supress lichen recovery. However, there are large quantities of sedges remaining, particularly Carex aquatilis, which is a valuable early winter forage.

Because the Lake Louise Flat was the major wintering ground, it received considerable attention and numerous vegetative studies have been conducted, including 14 exclosures built in 1955 and 1956. These stations have been examined periodically and range condition and trend data have been obtained.

Aerial surveys indicate that 56 percent of the Spruce type in the Lake Louise Flat has burned (Skoog 1968). Presently the lichen growth is dominately secondary types, such as Stereocaulon spp., Cladonia gracilis, C. uncialis, Cetraria cucullata, and C. islandica. Isolated patches of the preferred lichens Cladonia arbuscula and C. rangiferina occur, usually in depressions of the polygons where they are unavailable during the winter and also in protected sites under shrubs.

Throughout the Nelchina range, from the earlier studies in 1953 to those in 1970, the most palatable lichens were usually encountered only in isolated, scattered locations where they were protected from grazing, trampling or fire. The effects of fire have been spotty, and lichens occurring on a dense moss mat, which would be moist and resistant to burning, often were not burned. Permafrost polygons are characteristic of the Lake Louise Flat and lichen growth usually occurs on the top of the slightly elevated polygons. Usually shrubs are less dense and the area is more exposed to grazing and trampling. These sites are usually the most

severly damaged. Luxuriant stands of lichens often can be found in the border depressions adjacent to an elevated mound. This is due to the increased moisture content and moisture retention by the moss cover and protection by the shrubs. Overall, the shrubs, particularly blueberry, cranberry (Vaccinium vitis-idaea), narrow-leaved Labrador tea, shrub birch, and willows, were increasing at almost all stations examined. Sedges (Carex spp. and Eriophorum spp.) are usually a principal component of such a stand, although there has been very little indication of increase in the sedge cover at any of these stations. Observations indicate that the Nelchina herd has utilized sedges to a large extent, but, unfortunately, only one or two of the stations are in representative stands and very little change in the sedge cover has occurred with either protection or normal grazing. Apparently the sedges are quite able to withstand the current level of use.

All exclosures are showing signs of recovery of the lichen growth after 14 or 15 years of total protection. The recovery is by lichen species that occurred at the time of building the exclosure. These include Stereocaulon spp., Cladonia uncialis, C. arbuscula and C. rangiferina. There has been almost no recovery by Cladonia alpestris. Very likely C. rangiferina and C. arbuscula should be considered climax for the Flat due to the intense frost action and use by both moose and caribou. Most stations showed a continued deterioration of the lichens outside of the exclosure with the lower level of use that has been made since the mid 1950's. This is particularly true at Corky and Harris Lakes, which are close to the calving grounds. The caribou move across these stations annually in large

numbers. Deterioration of the total range, especially the lichens, has continued, but also numerous moss pedestals are apparent at several of the stations. Total cover has been severely reduced and large amounts of bare ground are now exposed. Several of the stations are located in stands that are suitable for studying recovery from fires, especially at Betty Ann Lake which experienced a rather recent fire. This station showed that 6 to 15 years with total protection were required for the first lichens to establish themselves. After 20 years the primary species, such as Cladonia gracilis and several of the funnel-form Cladonias were still about the only lichens present. Some of the stations on an old burn that occurred in 1924 or before showed that the recovery by Cladonia arbuscula and C. rangiferina usually occurred within 30 to 40 years following the fire. Station 12 is a good example showing the relatively slow progress that has been made in 15 years of total protection on an old burn. It appeared that recovery by the lichens had occurred within 30 years and that since that time, there had been very little change in the lichen cover or composition.

The condition of lichens in the Lake Louise Flat would have to be considered poor as they are still deteriorating. Lichen recovery will require a minimum of 15 years of total protection, which is unfeasible, since the caribou will likely be using the Flat in the future. Very likely moose will continue to be in the area and their movements will tend to retard improvement of the condition of lichens, as will frost action. The Flat contains an abundance of sedge forage and caribou are evidently utilizing this source to a large extent. Effort should be made in the future to more accurately determine the role of sedges in the winter diet of caribou because it is obvious that the Flat cannot be considered a major

wintering site based on the condition of lichens. The recovery by lichens within exclosures has shown marked changes in the last four years, and it appears that within the next 10 years, there will be very rapid changes in the condition and composition of lichens to a more nearly climax condition with total protection.

CONCLUSIONS

Palmer and Rouse (1945) reported that lichens on tundra ranges are quick to react to any disturbance and the length of time required for their recovery is directly proportional to the degree of disturbance. In the Heath type recovery was rapid following light grazing, but slow with heavy grazing. Palmer and Rouse also found that a depleted lichen range under complete protection required from 20-40 years for restoration of the original density and height. Their work is substantiated by the fact that at Unalakleet in a Heath type, total recovery of the original density of lichens has not occurred after 33 years, because the shrubs have become difficult to displace (Pegau 1970b).

With a wide diversity of habitats, a considerable variety of nutritional plants are available throughout a prolonged period during the brief summer at which time body maintenance and a rapid rate of growth takes place (Klein 1970). The caribou's feeding behavior enables them to select the highest quality forage available on the range. However, low population density and the opportunity to range over wide areas, as pointed out by Klein (1970b), are essential to the well-being of caribou. His studies of the St. Matthew reindeer herd (Klein, 1968), indicated that the drastic population decline occurred after the population reached a level at which the animals were no longer able to select a high quality diet because of the high population density and consequent deterioration of the range.

From the exclosure studies, it is apparent that the successional trend of the Nelchina range is towards a drier condition and subsequent increase in shrubs. The exclosure studies and the study of Palmer and Rouse (1945) show that use by caribou stimulates the growth of shrubs and the lichen cover is reduced. The shrubs have increased at almost all range stations on the Nelchina. Dwarf shrubs increase on tundra ranges, and once they become established, they are able to supress recovery of the fruticose lichens (Palmer and Rouse 1945, and Pegau, 1970b). Shrubs increase the value of a summer range but may reduce the quality of winter range. There has been no indication that shrubs are important in the winter diet of caribou.

On the Nelchina range, it is apparent that the recovery of the lichens that occurs usually consists of those species that were already on the site when the exclosures were established. There was some change in species composition, but normally the recovery has been primarily of those species already present at the time the areas were first protected.

Skoog(1968) presented considerable data on historical and recent population size of the Nelchina caribou herd. Evidently large scale population fluctuations have been characteristic of the herd since its earliest recorded history. Skoog (1968) states "A low point in numbers probably was reached during the late 1930's or early 1940's."

The Nelchina herd continued to increase during the 1950's and early 1960's, possibly reaching a peak in the early 1960's (Hemming, 1971). The increase in total numbers of the Nelchina herd was accompanied by an expansion of the "normal" Nelchina range, especially during the winter. During the 60's the caribou utilized a major portion of the

Wrangell Mountains area as part of their wintering range. Areas that previously had been used, such as the Lake Louise Flat now receive only sporadic use. Also during the early 1960's, the caribou used the northwestern quarter of the Nelchina range extensively, an area virtually untouched by caribou for at least 20 to 30 years.

Some of the earliest investigations on the Nelchina Range pointed out the fact that trampling constituted a major portion of the damage to lichens. Is it possible that the characteristically large population fluctuations of caribou have evolved with lichen suppression and recovery? Apparently even though the animals move out and utilize new areas, the continued sporadic use of previously heavily used areas suppresses lichen growth and prevents restoration of the lichens. From the exclosure studies it appears that lichens on the Nelchina need almost total protection for lengthy periods of time (over 25 years?) to recover fully, yet it only takes 5 to 8 years of intensive use to destroy climax lichen stands. The Nelchina caribou herd has been and possibly still is, undergoing the classic population dynamics of building up, expanding into new areas and then declining. The range is continuing to deteriorate and indications are that the recent population levels of the Nelchina herd may very well have been in excess of that the lichen flora could withstand.

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